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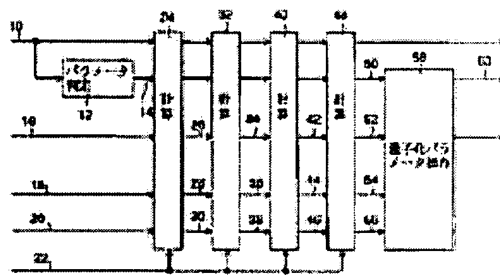
(54) CODE QUANTITY CONTROLLER

(57)Abstract:

PURPOSE: To improve the coding efficiency by using a deficient code quantity by a quantization device when the quantizer satisfying an object code quantity is selected and using an excess code quantity by a quantization device whose quantization width is smaller by one step so as to approach the code quantity to an object code quantity.



CONSTITUTION: A calculation section 32 executes calculation of a code quantity by an input quantization number 26 and the result revises deficient/excess data 28, 30, and the result is outputted to a next stage as deficient/excess data 36, 38. The operation is repeated by four stages to obtain final deficient/excess data 54, 56. That is, let a quantization number 52 decided finally be Qn, a caption 54 indicates deficient data quantity in the case of coding by the Qn and a caption 56 indicates a data quantity in excess when coded by a number Qn-1, A quantization parameter operation section 58 uses deficient/excess data to control a quantization parameter 50 to command the use of a quantization device shifted from the Qn in the unit of small blocks for the selected Qn to attain fine-adjustment of the code quantity.

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審査請求　未請求　請求項の数１　ＯＬ　（全 9 頁）

(21)出願番号　特願平5－211853

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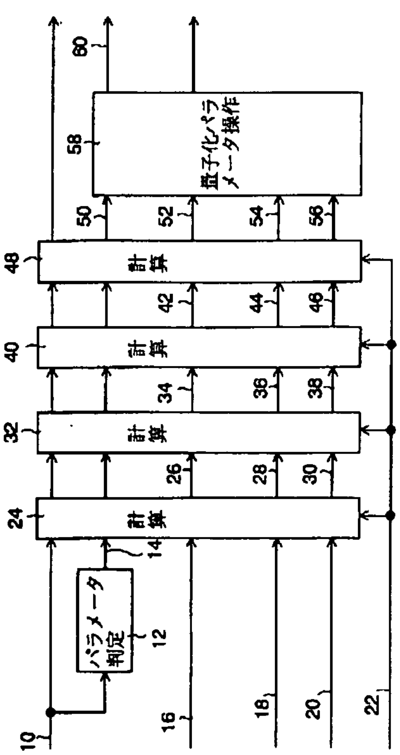
(54)【発明の名称】　符号量制御装置

(57)【要約】　　（修正有）

【目的】　目標符号量を満たす量子化器Ｑ$_n$が選択されたとき、更に目標符号量に近づけ符号化効率を改善する。

【構成】　複数の量子化器から目標符号量以下になる量子化器を２分探索で決定する際に、その不足データ量と、符号量が目標符号量より多くなる１つ隣りの量子化器による場合の超過データ量を算出し、最終的な不足／超過データ量５４／５６が得られる。これは最終的に決定された量子化番号５２をＱ$_n$とすると、５４はＱ$_n$で符号化した場合の、目標符号量２２に対する不足データ量を示し、５６はＱ$_{n-1}$で符号化した場合の目標符号量からの超過データ量を示す。この不足データ量と超過データ量を使って、量子化パラメータ操作部５８により、量子化パラメータ５０を操作し新たな量子化パラメータ６０を得て、大ブロック単位に選択されたＱ$_n$に対し、各小ブロック単位にＱ$_n$から相対的にシフトして適用する量子化器を決定する。



【特許請求の範囲】

【請求項１】　複数の小ブロックからなる大ブロック単位に符号量を一定にする符号量制御装置であって、符号化量を計算する複数段の符号量計算手段と、各段における目標符号量に対する不足／超過符号量を後段に伝達する伝達手段と、当該符号量計算手段の計算結果により、伝達された不足符号量及び超過符号量の何れか一方を更新する更新手段とを具備し、当該符号量計算手段の最終段で得られる当該不足／超過符号量に従い、上記各小ブロック符号化する際の量子化パラメータを操作し、もって発生符号量を当該目標符号量に近付けることを特徴とする符号量制御装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、符号化装置における符号量制御装置に関し、より具体的には可変長符号を用いる符号化装置における符号量制御装置に関する。

【０００２】

【従来の技術】図４に従来の高能率符号化装置の概略構成ブロック図を示す。図４において、２１０は大ブロック化部、２１２は小ブロック化部、２１４は直交変換部、２１６は量子化器　２１８は符号量計算部、２２０は量子化器選択部、２２２は可変長符号化部である。

【０００３】画像データは先ず、大ブロック化部２１０に入力し、ここでいくつかの大ブロックに分割される。この大ブロックは、後述する小ブロックをいくつか集めたものであり、大ブロック単位で符号量が一定になるように符号化が制御される。従って、原画像の情報量を平均化するように、予め画面上でシャッフルされた小ブロックを集めて大ブロックとすることが多い。

【０００４】小ブロック化部２１２は、各大ブロックをいくつかの小ブロックに分割する。この小ブロックは、後述する直交変換の単位となり、縦８画素、横８画素がよく使用される。

【０００５】直交変換部２１４は各小ブロックを直交変換し、その結果（変換係数と呼ぶ。）を出力する。直交変換は例えば、離散コサイン変換（ＤＣＴ）である。

【０００６】変換係数は、量子化部２１６により量子化されるが、その前に、符号量計算部２１８が、大ブロック単位での最終的な符号量を計算し、その結果に応じて、量子化器選択部２２０が、所定の符号量を達成できる、即ち目標符号量を越えない量子化器（又は量子化テーブル）を選択する。符号量計算部２１８の詳細は後述する。

【０００７】量子化部２１６により量子化された変換係数は、可変長符号化部２２２により可変長符号化される。具体的には、各小ブロック内の変換係数を低域側からジグザグ走査し、ランレングス符号化したあと、ハフマン符号化する。これらの一連の処理を含めて、本明細書では可変長符号化と呼ぶことにする。

【０００８】符号量計算部２１８の動作を説明する。Ｎ個の量子化器がある場合、予め量子化幅の小さい量子化器から順に１からＮの番号をつけ、Q_n（ｎ＝１～Ｎ）で各量子化器を特定することにする。符号量から見ると、ｎが小さいほど符号量が多くなる。前述したように、大ブロック単位で目標の符号量に抑えるために、大ブロック毎に１つのQ_nを選択するのがここでの課題である。

【０００９】適切な量子化器を決定するのに、例えば２分探索法を使用する。即ち、具体的には、中央の量子化器$Q_{N/2}$を選択し、実際に量子化及び可変長符号化を実行して符号量を計算する。その符号量が目標符号量よりも小さい場合、目的の量子化器はQ_1から$Q_{N/2}$の間にあるので、その中間の量子化器$Q_{N/4}$で同様の計算を繰り返す。逆に符号量が目標符号量よりも大きい場合、量子化器$Q_{3N/4}$で同様の計算を繰り返す。このようにして、Ｎ個の量子化器がある場合、$\log_2 N$回で目的の量子化器を決定できる。Ｎ＝１６の場合の量子化器の選択過程を図７に示す。図７で、３１０は符号量が目標符号量よりも小さい場合の選択方向、３１２は符号量が目標符号量より大きい場合の選択方向をそれぞれ示し、３１４はQ_6が選択される場合の選択経路を示す。

【００１０】符号量計算部２１８の具体的な回路ブロック図を図５に示す。２３０は入力データ、２３２は量子化パラメータ判定部、２３４は量子化パラメータ、２３６，２４２，２４６，２５０は量子化番号Q_n、２３８は目標符号量、２４０，２４４，２４８，２５２は計算部である。

【００１１】説明上、１つの大ブロックに含まれる小ブロック数をｋとすると、入力データ２３０は、ｋ個の小ブロックに対する変換係数を具備する。量子化パラメータ判定部２３２は、ｋ個の小ブロックのそれぞれに対してブロックの特徴を表わすパラメータを与え、量子化パラメータ２３４として出力する。この量子化パラメータ２３４は、１つの大ブロックに対して、ある量子化器Q_nが選択されたとき、その大ブロックに含まれるｋ個の小ブロック全てを同じ量子化器Ｑｎで量子化しないで、相対的に少しだけQ_nからシフトした量子化器（例えば、Q_{n+2}、Q_{n+1}、Q_{n-1}、Q_{n-2}など）を各小ブロックに適用するように制御する。

【００１２】計算部２４０，２４４，２４８，２５２は、前述の１回分の計算を行なう回路であり、計算部２４０には、入力データ２３０、量子化パラメータ２３４、量子化番号２３６及び目標符号量２３８が入力する。計算部２４０，２４４，２４８，２５２は、１つの大ブロック（ｋ個の小ブロック）分の符号量を計算し、次段で計算すべき量子化器番号２４２，２４６，２５０，２５４を出力する。

【００１３】計算部２４０，２４４，２４８，２５２の計算を何回か繰り返すことにより、この大ブロックに対

する最終の量子化器番号Q_nが得られる。図５はN＝１６の場合の例であり、２分探索であるので、初段の量子化器番号２３６はn＝８であり、４回の計算、即ち４つの計算部２４０，２４４，２４８，２５２により、適切な量子化器を決定できる。

【００１４】図６は計算部５１０の詳細なブロック図を示す。２６２は入力データ、２６４は量子化パラメータ、２６６は入力量子化番号、２６８は量子化部、２７０は量子化器選択部、２７２は可変長符号化部、２７４は符号量積算部、２７６は実際の符号量、２７８は目標符号量、２８０は減算器、２８２は符号量差分、２８４は符号判定部、２８６は符号判定結果、２９４は量子化番号選択部、２９６は出力量子化番号である。

【００１５】先ず、量子化器選択部２７０は、入力量子化番号２６４と量子化パラメータ２６６に従い、１つの量子化器又は量子化テーブルを選択し、量子化部２６８が、選択された量子化器又は量子化テーブルで入力データ２６２を量子化する。入力データ２６２は１つの大ブロック分、即ちk個の小ブロックの変換係数であり、量子化パラメータ２６６は小ブロック単位で変更されるので、量子化器選択部２７０は、それに応じて、選択する量子化器又は量子化テーブルをシフトする。

【００１６】可変長符号化部２７２は、量子化されたデータを可変長符号化し、その符号長を符号量積算部２７４に出力する。符号量積算部２７４は、入力する符号長をk個の小ブロックについて積算し、入力量子化番号２６４に対する大ブロックの実際の符号量を減算器２８０に出力する。減算器２８０は、符号量積算部２７４の出力２７６から目標符号量２７８を減算し、符号量差分２８２を出力する。この符号量差分２８２は、プラスのとき、現在の量子化番号では符号量が多すぎることを示し、逆にマイナスのとき、符号量が少ないことを示している。

【００１７】そこで、符号判定部２８４は、符号量差分２８２の極性（即ち、プラス又はマイナス）を判定し、量子化番号選択部２９４は、符号判定部２８４の判定結果２８６に応じて、入力量子化番号２６６を変換して出力量子化番号２９６とする。入力量子化番号をnとすると、符号量オーバーのときにはn＋（$N/2^{m+1}$）、符号量アンダーのときにはn－（$N/2^{m+1}$）を選択する。Nは量子化器数、mは計算部のm段目を示しており、図５に示す例では、N＝１６、m＝１～４である。また、最終段の計算部では、出力量子化番号が小数点以下となるが、四捨五入により、符号量オーバー時にはn＋１、符号量アンダー時にはnとなる。これらは、２分探索法で周知の処理である。

【００１８】

【発明が解決しようとする課題】図８及び図９を用いて、従来例の問題点を説明する。これらの図は何れも、最終的に選択された量子化器Q_nによる符号量及び１つだけ小さい量子化器Q_{n-1}による符号量と、目標符号量との大小関係を示しており、図中、a，bはそれぞれQ_n，Q_{n-1}の符号量と目標符号量との差を示す。即ち、Q_nで量子化した場合、目標符号量よりaだけ符号量が少なく、Q_{n-1}で量子化した場合、bだけ符号量がオーバーすることを示している。図８のような場合、aの値が小さく符号化効率が良い。しかし、図９のような場合には、aがかなり大きくなり、符号化効率が悪く、できれば量子化器Q_{n-1}を選択したいところだが、わずかにbだけの符号量オーバーが生じるのでやむを得ず量子化器Qnを選択している。

【００１９】本発明は、このような問題点を解決する符号量制御装置を提示することを目的とする。

【００２０】

【課題を解決するための手段】本発明に係る符号量制御装置は、複数の小ブロックからなる大ブロック単位に符号量を一定にする符号量制御装置であって、符号化量を計算する複数段の符号量計算手段と、各段における目標符号量に対する不足／超過符号量を後段に伝達する伝達手段と、当該符号量計算手段の計算結果により、伝達された不足符号量及び超過符号量の何れか一方を更新する更新手段とを具備し、当該符号量計算手段の最終段で得られる当該不足／超過符号量に従い、上記各小ブロック符号化する際の量子化パラメータを操作し、もって発生符号量を当該目標符号量に近付けることを特徴とする。

【００２１】

【作用】上記手段により、従来例と同様に決定した量子化手段を用いた場合の超過符号量の他に、これより１段だけ量子化幅の小さい量子化手段を用いた場合の超過符号量を得るようにした。そして、得られた不足符号量と超過符号量から、各小ブロック毎の量子化パラメータを制御して、全体として目標符号量に近付ける。

【００２２】

【実施例】以下、図面を参照して本発明の実施例を詳細に説明する。

【００２３】図１は、本発明の一実施例である符号量制御装置の概略構成ブロック図を示す。１０は入力データ、１２は量子化パラメータ判定部、１４は量子化パラメータ、１６，２６，３４，４２，５２は量子化番号Q_n、１８は初期不足データ量、２０は初期超過データ量、２２は目標符号量、２４，３２，４０，４８は計算部、２８，３６，４４，５４は不足データ量、３０，３８，４６，５６は超過データ量、５０は操作前の量子化パラメータ、５８は量子化パラメータ操作部、６０は操作後の量子化パラメータである。

【００２４】計算部２４，３２，４０，４８における動作の大部分は、図５に示した従来例と全く同じなので、説明を省略し、本実施例との特徴的動作を詳細に説明する。

【００２５】各計算部２４，３２，４０，４８には２つ

の入力と２つの出力が追加されており、２段目の計算部３２を例にとると、先ず、入力量子化番号２６による符号量計算が行なわれ、その結果によって前段から入力される不足データ量２８又は超過データ量３０のいずれかが更新されて、それぞれ不足データ量３６又は超過データ量３８として次段に出力される。ここで、不足／超過データ量とは、現在の量子化番号による符号量と目標符号量との差分を表わす。

【００２６】以上の動作を４段繰り返し、最終的な不足／超過データ量５４，５６が得られる。正確には、最終的に決定された量子化番号５２をQ_nとすると、符号５４は、Q_nで符号化した場合に目標符号量に不足するデータ量を示し、符号５６はQ_{n-1}で符号化した場合に目標符号量から超過するデータ量を示す。それぞれ、図８及び図９のａ，ｂに相当する。

【００２７】量子化パラメータ操作部５８は、この不足／超過データ量を用いて、量子化パラメータ５０（量子化パラメータ１４と同じ内容だが、遅延している。）を操作し、新たな量子化パラメータ６０を出力する。量子化パラメータ６０は、従来例でも述べたように、大ブロック単位に選択されたQ_nに対して、小ブロック単位にそのQ_nから相対的にシフトした量子化器を用いるように指示するパラメータであり、ｋ個のうちのいくつかを操作することで符号量の微調整が可能になる。

【００２８】次に、計算部２４，３２，４０，４８の詳細な回路構成を図２に示す。図２において、６２は入力データ、６４は量子化パラメータ、６６は入力量子化番号、６８は量子化部、７０は量子化器選択部、７２は可変長符号化部、７４は符号量積算部、７６は実際の符号量、７８は目標符号量、８０は減算器、８２は符号量差分、８４は符号判定部、８６は符号判定結果、８８は不足データ量入力、９０は超過データ量入力、９２は切換えスイッチ、９４は量子化番号選択部、９６は出力量子化番号、９８は不足データ量出力、１００は超過データ量出力である。

【００２９】図２で、従来例の図６と同じ部分は同じに動作するので、図２で追加した部分を詳細に説明する。

【００３０】符号量積算部７４は、図６で説明したように、入力量子化番号６６に対する実際の符号量を出力線７６上に出力する。減算器８０は実際の符号量７６から目標符号量７８を減算し、符号量差分８２を出力する。符号判定結果８６は、符号量差分８２の符号、即ち極性を示す。

【００３１】スイッチ９２は符号判定結果８６により、入力した不足データ量８８及び超過データ量９０のいずれか一方を符号量差分８２で更新して、出力線９８，１００に出力する。更新されないデータ量は、そのまま出力される。例えば、符号量がオーバーした場合、図にあるように不足データ量８８はそのまま出力され、超過データ量９０はこの計算部でオーバーしたデータ量８２の値で置換されて出力される。

【００３２】この構成により、図１において４段の計算部を経由すると、信号線５４，５６上に目的の不足／超過データ量が得られる。これを図７を用いて説明する。図７において、３１４は量子化器Q_6が選択される過程を示している。矢印を逆にたどると、Q_6とQ_5の符号量計算が４段目及び３段目でなされており、目的のデータ量が得られることがわかる。

【００３３】もう一つのQ_9の場合を考えると、４段目でQ_9の不足データ量が得られ、１段目はQ_8の超過データ量が得られる。特に、１段目の超過データ量は、２～４段目で符号量がオーバーしないので途中で書き換えられずに最後まで伝送される。他のQ_nも同様にして不足／超過データのいずれか一方が１回も計算されないので、正しい結果が得られない。

【００３４】図１の量子化パラメータ操作部５８の詳細な回路ブロック図を図３に示す。１１０は量子化パラメータ入力、１１２は選択された量子化番号Q_n、１１４は不足データ量、１１６は超過データ量、１１８は除算器、１２２は乗算器、１２６は加算器、１３０は比較器、１３２は切換えスイッチ、１３４は量子化パラメータ出力である。

【００３５】先ず、入力された不足／超過データ量１１０，１１２を図８及び図９に対応してそれぞれａ，ｂ（ａ≧０、ｂ≧０）とすると、除算器１１８はａ／（ａ＋ｂ）を計算し、量子化番号を１つ小さくした場合に増加する符号量に対する現在の不足データ量の割合１２０を出力する。１つ量子化番号を小さくすることは、量子化番号を変えないで、ｋ個の量子化パラメータ全部を操作して、各小ブロックの量子化番号を１だけ小さい方にシフトするのと等価であるから、この割合１２０を乗算器１２２でｋ倍することで、ｋ個のパラメータの内、何個を操作すれば良いかがわかる。

【００３６】加算器１２６は、量子化パラメータを操作する。具体的には、ここでは、パラメータを１だけ増加すれば、１つ小さい量子化器にシフトされると仮定している。入力されたｋ個の量子化パラメータ１１０のうち、乗算器１２２の出力１２４で指定される個数のパラメータが、加算器１２６で１だけパラメータ値を増加され、新たなパラメータとして出力１２８に出力される。

【００３７】比較器１３０は量子化番号１１２が１又は１６でないか否かを判定し、１又は１６のときには前述の問題があるのでスイッチ１３２により操作前のパラメータ１１０を出力するようにする。なお、ここでは乗算器１２２の出力１２４で指定されるパラメータ数を割合１２０としたが、実際には符号量オーバーの可能性があるので、多少少なめにするのがよい。

【００３８】また、加算器１２６で量子化パラメータ値を増加する際、どの小ブロックから行なうかについては、例えばＹ信号と色差信号のブロックがある場合はＹ

信号のブロックから順に、あるいは既に量子化パラメータ値が大きいものは後回しにして、パラメータ値の小さいものから順に、といった方法が考えられる。

【0039】本発明の一実施例を説明したが、ここで、本発明の基本的な考え方を改めて説明する。各小ブロックの量子化パラメータｋ個全てを１つ小さい量子化器を選ぶように操作することは、量子化パラメータを全く操作しないで大ブロック全体の量子化番号Q_nの代わりにQ_{n-1}を用いることと同等であり、従って、０～ｋ個の量子化パラメータを操作すれば、等価的に量子化器Q_n～Q_{n-1}が得られることになる。

【0040】

【発明の効果】以上の説明により容易に理解できるように、本発明によれば、目標符号量を満たす量子化器Q_nが選択されたとき、Q_nによる不足符号量とQ_{n-1}による超過符号量を用いることで、更に目標符号量近付けることができ、符号化効率が改善される。

【図面の簡単な説明】

【図１】　本発明の一実施例である符号量制御装置の概略構成ブロック図である。

【図２】　計算部２４，３２，４０，４８の詳細な回路構成ブロック図である。

【図３】　量子化パラメータ操作部５８の詳細な回路ブロック図である。

【図４】　従来の高能率符号化装置の概略構成ブロック図である。

【図５】　符号量計算部２１８の概略回路ブロック図である。

【図６】　計算部２４０，２４４，２４８，２５２の詳細なブロック図である。

【図７】　量子化器の選択過程の一例である。

【図８】　量子化器Q_n，Q_{n-1}の符号量と目標符号量の関係の説明図である。

【図９】　量子化器Q_n，Q_{n-1}の符号量と目標符号量の関係の説明図である。

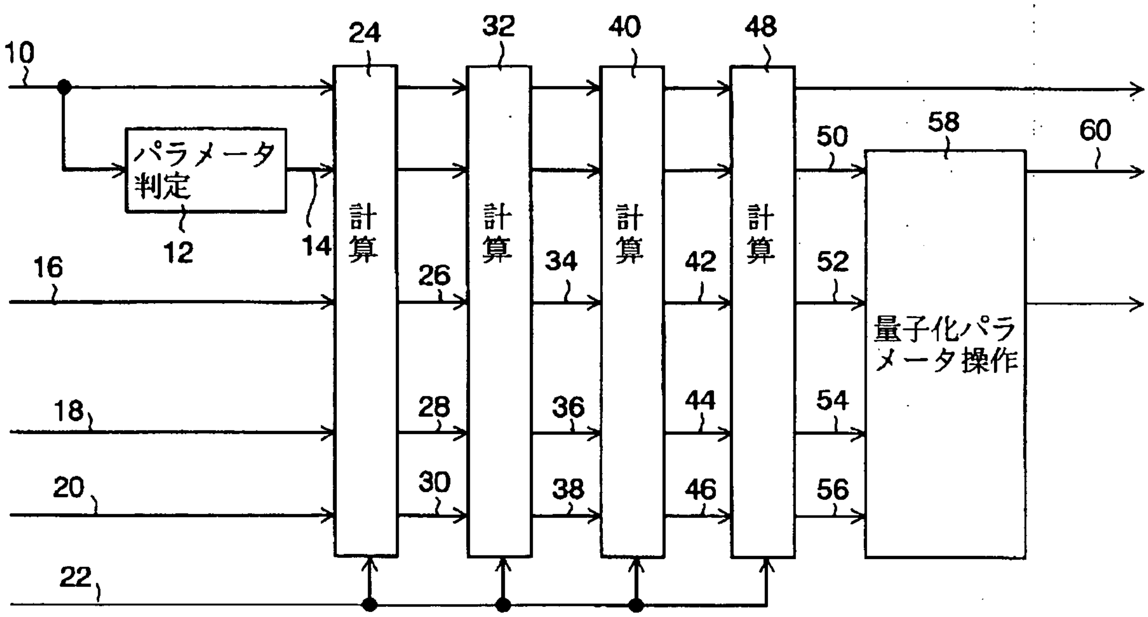
【符号の説明】

１０：入力データ
１２：量子化パラメータ判定部
１４：量子化パラメータ
１６，２６，３４，４２，５２：量子化番号Q_n
１８：初期不足データ量
２０：初期超過データ量
２２：目標符号量
２４，３２，４０，４８：計算部
２８，３６，４４，５４：不足データ量
３０，３８，４６，５６：超過データ量
５０：操作前の量子化パラメータ
５８：量子化パラメータ操作部
６０：操作後の量子化パラメータ
６２：入力データ
６４：量子化パラメータ
６６：入力量子化番号
６８：量子化部
７０：量子化器選択部
７２：可変長符号化部
７４：符号量積算部
７６：実際の符号量
７８：目標符号量
８０：減算器
８２：符号量差分
８４：符号判定部
８６：符号判定結果
８８：不足データ量入力
９０：超過データ量入力
９２：切換えスイッチ
９４：量子化番号選択部
９６：出力量子化番号
９８：不足データ量出力
１００：超過データ量出力
１１０：量子化パラメータ入力
１１２：選択された量子化番号Q_n
１１４：不足データ量
１１６：超過データ量
１１８：除算器
１２２：乗算器
１２６：加算器
１３０：比較器
１３２：切換えスイッチ
１３４：量子化パラメータ出力
２１０：大ブロック化部
２１２：小ブロック化部
２１４：直交変換部
２１６：量子化器
２１８：符号量計算部
２２０：量子化器選択部
２２２：可変長符号化部
２３０：入力データ
２３２：量子化パラメータ判定部
２３４：量子化パラメータ
２３６，２４２，２４６，２５０，２５４：量子化番号Q_n
２３８：目標符号量
２４０，２４４，２４８，２５２：計算部
２６２：入力データ
２６４：量子化パラメータ
２６６：入力量子化番号
２６８：量子化部
２７０：量子化器選択部
２７２：可変長符号化部
２７４：符号量積算部

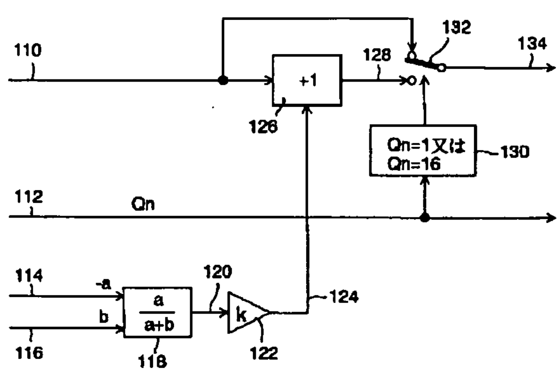
276：実際の符号量
278：目標符号量
280：減算器
282：符号量差分
284：符号判定部
286：符号判定結果

＊294：量子化番号選択部
296：出力量子化番号
310：符号量が目標符号量よりも小さい場合の選択方向
312：符号量が目標符号量より大きい場合の選択方向
＊ 314：Q_6が選択される場合の選択経路

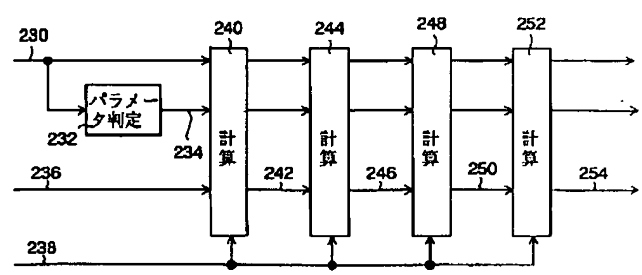
【図1】



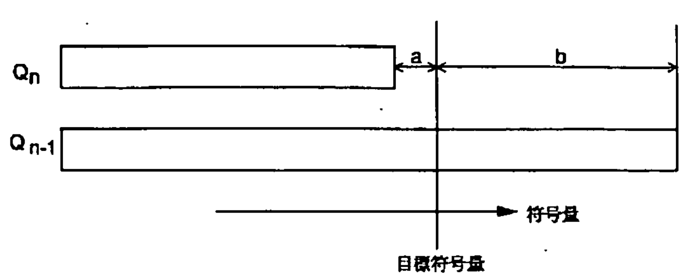
【図3】



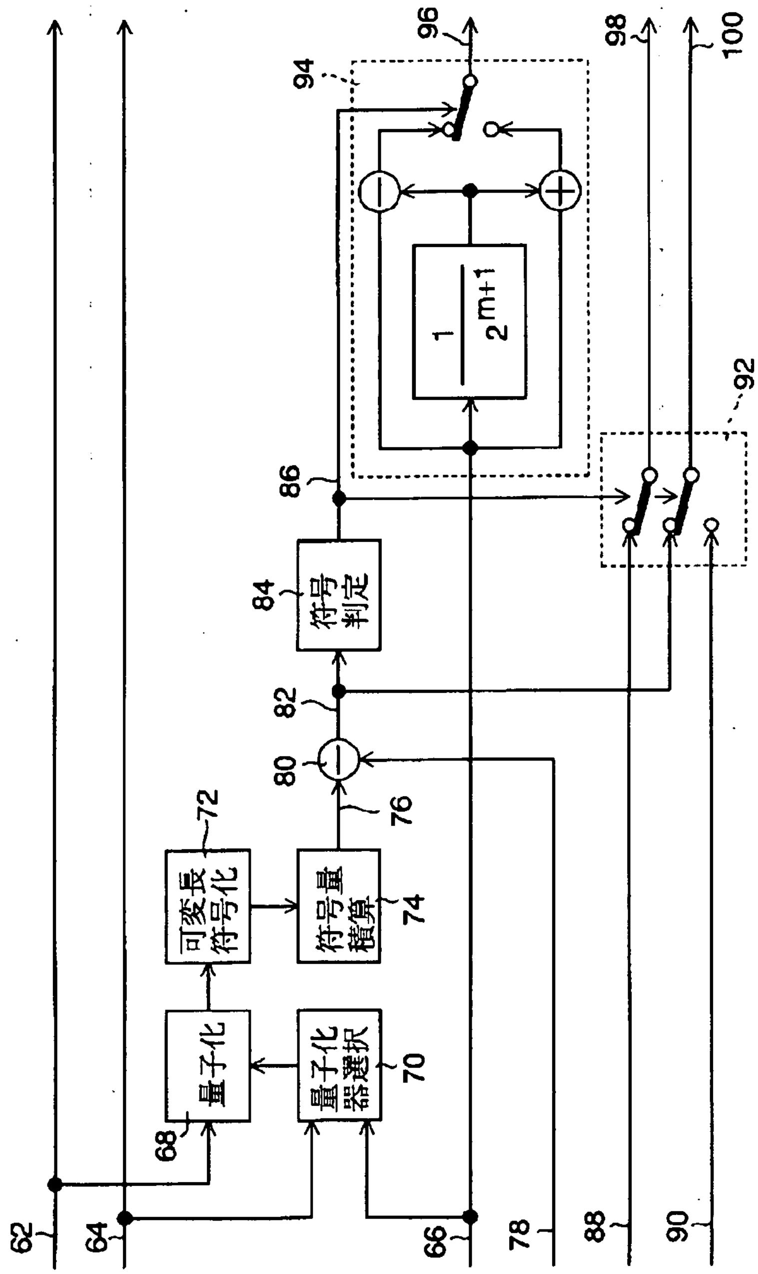
【図5】



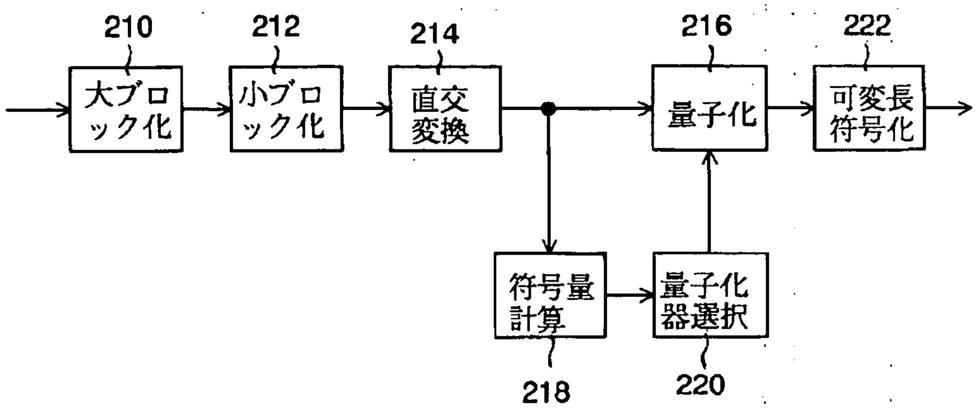
【図8】



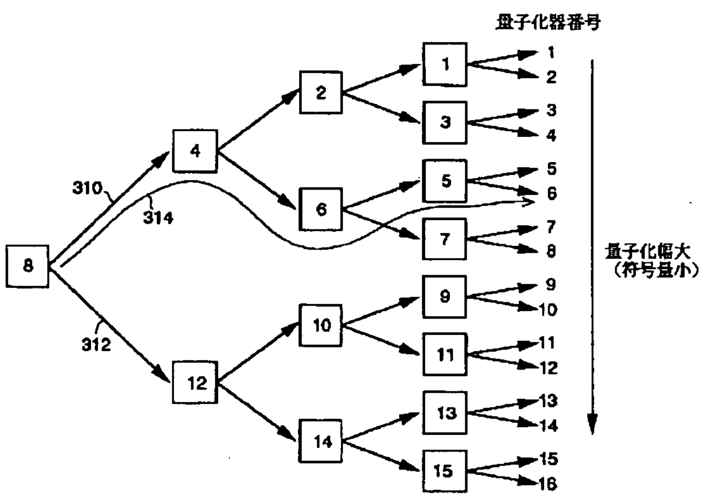
【図2】


量子化
量子化器選択
可変長符号化
符号量積算
符号判定
1
2m+1
62
64
66
68
70
72
74
76
78
80
82
84
86
88
90
92
94
96
98
100

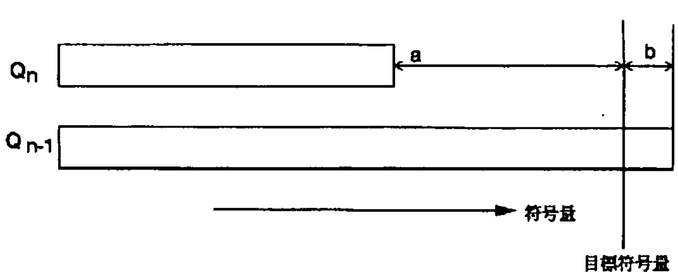
【図4】


210
212
214
216
222
大ブロック化
小ブロック化
直交変換
量子化
可変長符号化
符号量計算
量子化器選択
218
220

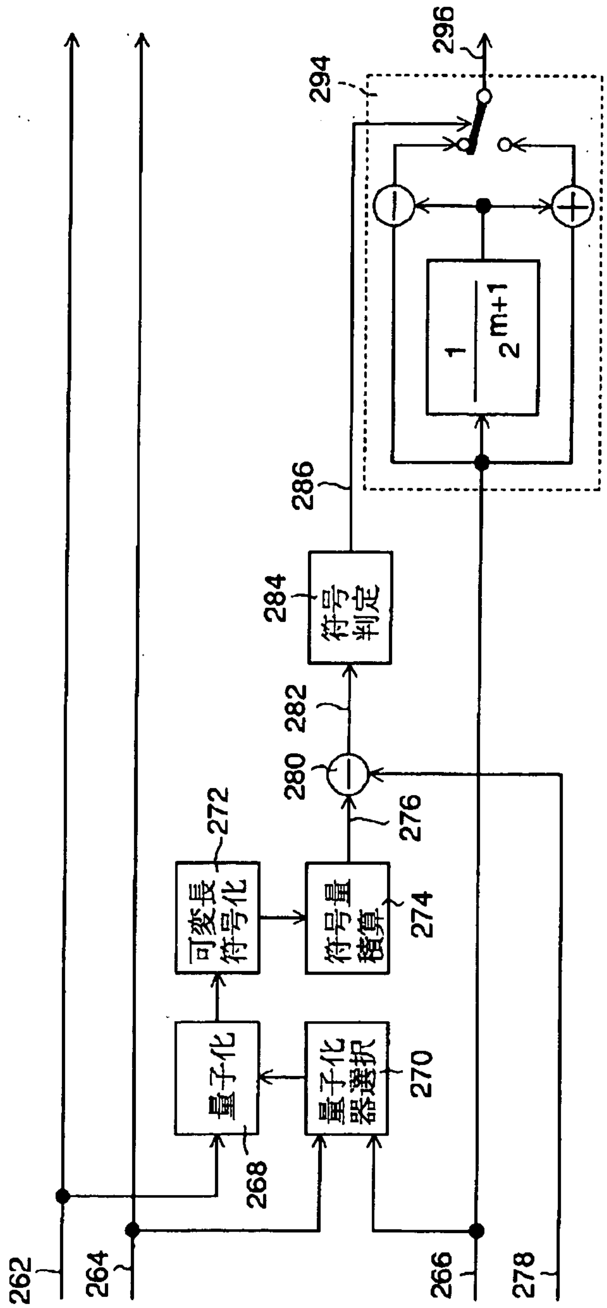
【図7】


量子化器番号
量子化幅大（符号量小）
310
314
312

【図9】


Qn
Qn-1
a
b
符号量
目標符号量

【図6】


262
264
266
278
268
量子化
270
量子化器選択
272
可変長符号化
274
符号量積算
276
280
282
284
符号判定
286
294
1
2 m+1
296

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(57) **Abstract**(Modified)
Objects of the Invention When quantizer Q_n which fills target code quantity is chosen, it brings close to target code quantity, and encoding efficiency is improved.
Elements of the Invention When determining a quantizer which becomes below target code quantity from two or more quantizers by dichotomizing search, the insufficient data volume and the amount of excess data in case a code amount is based on a quantizer of one next door which increase in number more than target code quantity are computed, and final shortage / amounts 54/56 of excess data are obtained. When this makes Q_n the quantization number 52 determined eventually, 54 shows insufficient data volume to the target code quantity 22 at the time of coding by Q_n, and 56 shows the amount of excess data from target code quantity at the time of coding by Q_{n-1}. Using this insufficient data volume and the amount of excess data, by the quantization parameter final controlling element 58. The quantization parameter 50 is operated, the new quantization parameter 60 is obtained, and a quantizer which is relatively shifted to each small block unit from Q_n, and is applied to it is determined to Q_n chosen as a large block unit.

Claim(s)

Claim 1 Two or more steps of code amount calculating means which calculate encoding quantity by being a code quantity controller which makes a code amount at regularity a large block unit which consists of two or more small blocks, The shortage / excess code amount to target code quantity in each stage by a calculation result of a means of communication transmitted to the latter part, and

the code amount calculating means concerned. An update means which updates either one of a transmitted insufficient code amount and an excess code amount is provided, A code quantity controller operating and having a quantization parameter at each above-mentioned time of carrying out small block coding according to the shortage / the excess code amount concerned obtained in a final stage of the code amount calculating means concerned, and bringing a generated code amount close to the target code quantity concerned.

Detailed Description of the Invention
0001
Industrial Application This invention more specifically relates to the code quantity controller in the coding equipment using a variable length code about the code quantity controller in coding equipment.
0002
Description of the Prior Art The outline configuration block figure of conventional highly efficient coding equipment is shown in drawing 4. in drawing 4 -- 210 -- as for quantizer 218, a small block-ized part and 214 are **a quantizer selecting part and 222** variable length coding sections a code quantity calculation section and 220 an orthogonal transformation section and 216 a large blocking part and 212.
0003 First, image data is inputted into the large blocking part 210, and is divided into some large blocks here. This large block collects some small blocks mentioned later, and coding is controlled so that a code amount becomes fixed by a large block unit. Therefore, the small blocks beforehand shuffled on the screen are collected, and it is considered as a large block in many cases so that the amount of information of an original image may be equalized.
0004 The small block-ized part 212 divides each large block into some small blocks. This small block serves as a unit of the orthogonal transformation mentioned later, and 8 pixels long and 8 pixels wide are often used.
0005 The orthogonal transformation section 214 carries out orthogonal transformation of each small block, and outputs the result (it is called a conversion factor.). Orthogonal transformation is a discrete cosine transform (DCT).
0006 Although quantized by the quantizing part 216, a conversion factor, Before that, the code quantity calculation section 218 calculates the final code amount in a large block unit, and the quantizer selecting part 220 chooses the quantizer (or quantization table) which can attain a predetermined code amount, namely, does not exceed target code quantity according to the result. The details of the code quantity calculation section 218 are mentioned later.
0007 Variable length coding of the conversion factor quantized by the quantizing part 216 is carried out by the variable length coding section 222. After carrying out the zigzag scan of the conversion factor in each small block and carrying out run length coding from the low-pass side, specifically, Huffman encoding is carried out. On these Descriptions, it will be called variable length coding including these the processings of a series of.
0008 Operation of the code quantity calculation section 218 is explained. When there are N quantizers, the number of 1 to N is beforehand given sequentially from a quantizer with small quantization width, and each quantizer will be specified by Q_n (n=1-N). If it sees from a code amount, a code amount will increase, so that n is small. As mentioned above, in order to hold down to a target code amount by a large block unit, it is SUBJECT here to choose one Q_n for every large block.
0009 Although a suitable quantizer is determined, binary search is used, for example. Namely, a code amount is calculated by choosing central quantizer $Q_{N/2}$, and specifically performing quantization and variable length coding actually. Since the target quantizer is between Q **from Q_1** N/2 when the code amount is smaller than target code quantity, the same calculation is repeated by middle its quantizer $Q_{N/4}$. Conversely, when a code amount is larger than target code quantity, the same calculation is repeated by quantizer $Q_{3N/4}$. Thus, when there are N quantizers, the target quantizer can be determined by $\log_2 N$ time. The selection process of the quantizer in N= 16 is

shown in drawing 7. Drawing 7 shows a selected direction when a code amount of 310 is smaller than target code quantity, and a selected direction when a code amount of 312 is larger than target code quantity, respectively, and 314 shows a selection course in case Q_6 is chosen.

0010 The concrete circuit block figure of the code quantity calculation section 218 is shown in drawing 5. As for a quantization parameter and 236,242,246,250, input data and 232 are **target code quantity and 240,244,248,252** calculation parts quantization number Q_n and 238 a quantization parameter judgment part and 234 230.

0011 On explanation, if the number of small blocks contained in one large block is set to k, the input data 230 possesses the conversion factor to k small blocks. The quantization parameter judgment part 232 gives the parameter with which the feature of a block is expressed to each of k small blocks, and outputs it as the quantization parameter 234. This quantization parameter 234 without quantizing all k small blocks contained in that large block with the same quantizer Qn, when certain quantizer Q_n is chosen to one large block, It controls to apply the quantizers (for example, Q_{n+2}, Q_{n+1}, Q_{n-1}, Q_{n-2}, etc.) which shifted only a few from Q_n relatively to each small block.

0012 The calculation part 240,244,248,252 is a circuit which calculates the above-mentioned draft. The input data 230, the quantization parameter 234, the quantization number 236, and the target code quantity 238 input into the calculation part 240.
The calculation part 240,244,248,252 outputs the quantizer number 242,246,250,254 which should calculate the code amount for one large block (k small blocks), and should be calculated by the next step.

0013 By repeating calculation of the calculation part 240,244,248,252 several times, the last quantizer number Q_n to this large block is obtained. Since drawing 5 is an example in N= 16 and it is dichotomizing search, the quantizer number 236 of the first rank is n= 8, and can determine a suitable quantizer by four calculations 240,244,248,252, i.e., four calculation parts.

0014 Drawing 6 shows the detailed block diagram of the calculation part 510. 262 input data and 264 a quantization parameter and 266 An input quantity child-ized number, 268 a quantizing part and 270 a quantizer selecting part and 272 A variable length coding section, a code amount integrating part, the code amount in which 274 is actual as for 276, and 278 -- as for a code judging part and 286, a subtractor and 282 are **a quantization number selecting part and 296** output quantity child-ized numbers a code judging result and 294 code amount difference and 284 target code quantity and 280.

0015 First, the quantizer selecting part 270 chooses one quantizer or a quantization table according to the input quantity child-ized number 264 and the quantization parameter 266, and the quantizing part 268 quantizes the input data 262 on the selected quantizer or quantization table. The input data 262 is a conversion factor for one large block (i.e., k small blocks), and since the quantization parameter 266 is changed per small block, the quantizer selecting part 270 shifts the quantizer or quantization table to choose according to it.

0016 The variable length coding section 272 carries out variable length coding of the quantized data, and outputs the code length to the code amount integrating part 274. The code amount integrating part 274 integrates the code length who inputs about k small blocks, and outputs the actual code amount of the large block over the input quantity child-ized number 264 to the subtractor 280. The subtractor 280 subtracts the target code quantity 278 from the output 276 of the code amount integrating part 274, and outputs the code amount difference 282. At the time of plus, this code amount difference 282 shows that there are too many code amounts by the present quantization number, and shows conversely that there are few code amounts by it at the time of minus.

0017 Then, the code judging part 284 judges the polarity (namely, plus or minus) of the code amount difference 282, and according to the decision result 286 of the code judging part 284, the quantization number selecting part 294 changes the input quantity child-ized number 266, and makes it the output quantity child-ized number 296. If an input quantity child-ized number is set to n, at the time of code amount over, n- $(N/2^{m+1})$ will be chosen at the time of n+ $(N/2^{m+1})$ and a code amount undershirt. In the example which N shows the number of quantizers, and m shows eye m stage of the calculation part, and is shown in drawing 5, it is N= 16 and m= 1-4. In the

calculation part of a final stage, although an output quantity child-ized number becomes below in a decimal point, at the time of code amount over, it is set to n by rounding off at the time of n+1 and a code amount undershirt. These are processings of well-known by binary search.

0018

Problem(s) to be Solved by the Invention The problem of a conventional example is explained using drawing 8 and drawing 9. Each of these figures shows only the code amount by eventually selected quantizer Q_n, and one size relation of the code amount by small quantizer Q_{n-1}, and target code quantity, and a and b show the difference of the code amount of Q_n and Q_{n-1}, and target code quantity among a figure, respectively. That is, when it quantizes by Q_n, only a has few code amounts than target code quantity, and when it quantizes by Q_{n-1}, it is shown that a code amount exceeds only b. Case **like drawing 8** , the value of a is small and encoding efficiency is good. However, case **like drawing 9** , a became quite large, encoding efficiency is bad, and if it can do, since the code amount over of only only b arises, the quantizer Qn will have been chosen unavoidably but the place to choose quantizer Q_{n-1} as.

0019 An object of this invention is to show the code quantity controller which solves such a problem.

0020

Means for Solving the Problem Two or more steps of code amount calculating means which calculate encoding quantity by a code quantity controller concerning this invention being a code quantity controller which makes a code amount at regularity a large block unit which consists of two or more small blocks, The shortage / excess code amount to target code quantity in each stage by a calculation result of a means of communication transmitted to the latter part, and the code amount calculating means concerned. An update means which updates either one of a transmitted insufficient code amount and an excess code amount is provided, According to the shortage / the excess code amount concerned obtained in a final stage of the code amount calculating means concerned, it operates and has a quantization parameter at each above-mentioned time of carrying out small block coding, and a generated code amount is brought close to the target code quantity concerned.

0021

FunctionThe excess code amount at the time of using one step of quantization means with small quantization width from this other than the excess code amount at the time of using the quantization means similarly determined as the conventional example by the above-mentioned means was obtained. And from the obtained insufficient code amount and an excess code amount, the quantization parameter for every small block is controlled, and it brings close to target code quantity as a whole.

0022

ExampleHereafter, with reference to Drawings, working example of this invention is described in detail.

0023 Drawing 1 shows the outline configuration block figure of the code quantity controller which is one working example of this invention. 10 input data and 12 a quantization parameter judgment part and 14 A quantization parameter, Quantization number Q_n and 18 16, 26, 34, 42, and 52 Initial insufficient data volume, 20 the amount of initial excess data, and 22 target code quantity, and 24, 32, 40 and 48 A calculation part, As for the amount of excess data, and 50, 28, 36, 44, and 54 are **a quantization parameter final controlling element and 60** the quantization parameters after operation insufficient data volume, and 30, 38, 46 and 56 the quantization parameter before operation, and 58.

0024 Since the great portion of operation in the calculation parts 24, 32, 40, and 48 is completely the same as the conventional example shown in drawing 5, it omits explanation and explains characteristic operation with this example in detail.

0025 If two inputs and two outputs are added to each calculation parts 24, 32, 40, and 48 and the 2nd step of calculation part 32 is taken for an example, First, code amount calculation by the input quantity child-ized number 26 is performed, either **which is inputted from the preceding paragraph by the result** the insufficient data volume 28 or the amount 30 of excess data is updated, and it is outputted to the next step as the insufficient data volume 36 or the amount 38

of excess data, respectively. Here, the difference of the code amount and target code quantity by the present quantization number is expressed as shortage/the amount of excess data.
0026 The above four steps of operations are repeated and final shortage / amounts 54 and 56 of excess data are obtained. When the quantization number 52 determined eventually correctly is made into Q_n, the numerals 54 show the data volume which target code quantity runs short of, when it codes by Q_n, and the numerals 56 show the data volume exceeded from target code quantity, when it codes by Q_{n-1}. Respectively, it is equivalent to a of drawing 8 and drawing 9, and b.
0027 Using this shortage/amount of excess data, the quantization parameter final controlling element 58 operates the quantization parameter 50 (delayed although it is the same contents as the quantization parameter 14.), and outputs the new quantization parameter 60. The quantization parameter 60 is a parameter it is directed that uses the quantizer relatively shifted from the Q_n per small block to Q_n chosen as the large block unit, as the conventional example also described. Fine adjustment of a code amount is attained by operating some of the k pieces.

0028 Next, the detailed circuitry of the calculation parts 24, 32, 40, and 48 is shown in drawing 2. In drawing 2, 62 input data and 64 a quantization parameter and 66 An input quantity child-ized number, A quantizing part and 70 for 68 a quantizer selecting part and 72 a variable length coding section and 74 A code amount integrating part, A code amount with actual 76 and 78 target code quantity and 80 a subtractor and 82 Code amount difference, 84 -- a code judging part and 86 -- a code judging result and 88 -- as for a quantization number selecting part and 96, the amount input of excess data and 92 are **an insufficient data volume output and 100** the amount outputs of excess data an output quantity child-ized number and 98 a changeover switch and 94 an insufficient data volume input and 90.
0029 Since the portion same at drawing 2 as drawing 6 of a conventional example similarly operates, the portion added by drawing 2 is explained in detail.
0030 The code amount integrating part 74 outputs the actual code amount to the input quantity child-ized number 66 on the output line 76, as drawing 6 explained. The subtractor 80 subtracts the target code quantity 78 from the actual code amount 76, and outputs the code amount difference 82. The code judging result 86 shows the numerals of the code amount difference 82, i.e., polarity.
0031 By the code judging result 86, the switch 92 updates either one of **which was inputted** the insufficient data volume 88 and the amount 90 of excess data by the code amount difference 82, and outputs it to the output line 98,100. The data volume which is not updated is outputted as it is. For example, when a code amount exceeds, as shown in a figure, the insufficient data volume 88 is outputted as it is, and the amount 90 of excess data is replaced and outputted with the value of the data volume 82 exceeded by this calculation part.
0032 If it goes via four steps of calculation parts in drawing 1 by this composition, target shortage/amount of excess data will be obtained on the signal wire 54 and 56. This is explained using drawing 7. In drawing 7, 314 shows the process in which quantizer Q_6 is chosen. When an arrow is followed conversely, it turns out that code amount calculation of Q_6 and Q_5 is made in the 4th step and the 3rd step, and the target data volume is obtained.
0033 Considering the case of another Q_9, the insufficient data volume of Q_9 is obtained in the 4th step, and, as for the 1st step, the amount of excess data of Q_8 is obtained. Since a code amount does not exceed in the 2-4th step, the 1st step of especially amount of excess data is transmitted to the last, without being rewritten on the way. As for other Q_n, since either one of shortage/excess data are not calculated once similarly, a right result is not obtained.
0034 The detailed circuit block figure of the quantization parameter final controlling element 58 of drawing 1 is shown in drawing 3. a quantization parameter input, quantization number Q_n for which 110 was chosen 112, and 114 -- insufficient data volume and 116 -- as for an adding machine and 130, a divider and 122 are **a changeover switch and 134** quantization parameter outputs a comparator and 132 a multiplier and 126 the amount of excess data, and 118.
0035first, the present insufficient data volume to the code amount which increases when the

inputted shortage / the amount 110,112 of excess data were set to a and b (a>=0, b>=0) corresponding to drawing 8 and drawing 9, respectively, the divider 118 calculates a/(a+b) and a quantization number is made small one -- 120 is outputted comparatively. Making 1 quantization number small operates all k quantization parameters without changing a quantization number, Since it is equivalent to only 1 shifting the quantization number of each small block to the smaller one, it understands whether it should operate how many of k parameters by increasing this rate 120 k times with the multiplier 122.

0036 The adding machine 126 operates a quantization parameter. If only 1 increases a parameter, specifically, it will be assumed here that it is shifted to a quantizer small **one** . Only 1 has parameter value increased with the adding machine 126, and the parameter of the number specified with the output 124 of the multiplier 122 among the k inputted quantization parameters 110 is outputted to the output 128 as a new parameter.

0037 The comparator 130 judges whether the quantization number 112 is 1 or 16, and since there is the above-mentioned problem at the time of 1 or 16, it is made to output the parameter 110 before operation with the switch 132. Although the number of parameters specified with the output 124 of the multiplier 122 here was comparatively set to 120, since there is possibility of code amount over actually, it is good to lessen some slightly.

0038 When increasing a quantization parameter value with the adding machine 126, about from which small block it carries out. for example, the order from the thing which has small parameter value and which makes deferment order or what has an already large quantization parameter value from the block of a Y signal when there is a block of a Y signal and a color-difference signal -- the said method can be considered.

0039 Although one working example of this invention was described, the fundamental view of this invention is explained anew here. Operating all k quantization parameters of each small block so that a quantizer small **one** may be chosen, If it is equivalent to using Q_{n-1} instead of quantization number Q_n of the whole large block without completely operating a quantization parameter, therefore 0-k quantization parameters are operated, quantizer Q_n - Q_{n-1} will be obtained equivalent.

0040

Effect of the Invention When quantizer Q_n which fills target code quantity is chosen according to this invention so that he can understand easily by the above explanation, by using the insufficient code amount by Q_n, and the excess code amount by Q_{n-1}, ************ attachment ****** is made further and encoding efficiency is improved.

Industrial Application This invention more specifically relates to the code quantity controller in the coding equipment using a variable length code about the code quantity controller in coding equipment.

Description of the Prior Art The outline configuration block figure of conventional highly efficient coding equipment is shown in drawing 4. in drawing 4 -- 210 -- as for quantizer 218, a small block-ized part and 214 are **a quantizer selecting part and 222** variable length coding sections a code quantity calculation section and 220 an orthogonal transformation section and 216 a large blocking part and 212.

0003 First, image data is inputted into the large blocking part 210, and is divided into some large blocks here. This large block collects some small blocks mentioned later, and coding is controlled so that a code amount becomes fixed by a large block unit. Therefore, the small blocks beforehand shuffled on the screen are collected, and it is considered as a large block in many cases so that the amount of information of an original image may be equalized.

0004 The small block-ized part 212 divides each large block into some small blocks. This small block serves as a unit of the orthogonal transformation mentioned later, and 8 pixels long and 8

pixels wide are often used.

0005 The orthogonal transformation section 214 carries out orthogonal transformation of each small block, and outputs the result (it is called a conversion factor.). Orthogonal transformation is a discrete cosine transform (DCT).

0006 Although quantized by the quantizing part 216, a conversion factor, Before that, the code quantity calculation section 218 calculates the final code amount in a large block unit, and the quantizer selecting part 220 chooses the quantizer (or quantization table) which can attain a predetermined code amount, namely, does not exceed target code quantity according to the result. The details of the code quantity calculation section 218 are mentioned later.

0007 Variable length coding of the conversion factor quantized by the quantizing part 216 is carried out by the variable length coding section 222. After carrying out the zigzag scan of the conversion factor in each small block and carrying out run length coding from the low-pass side, specifically, Huffman encoding is carried out. On these Descriptions, it will be called variable length coding including these the processings of a series of.

0008 Operation of the code quantity calculation section 218 is explained. When there are N quantizers, the number of 1 to N is beforehand given sequentially from a quantizer with small quantization width, and each quantizer will be specified by Q_n (n=1-N). If it sees from a code amount, a code amount will increase, so that n is small. As mentioned above, in order to hold down to a target code amount by a large block unit, it is SUBJECT here to choose one Q_n for every large block.

0009 Although a suitable quantizer is determined, binary search is used, for example. Namely, a code amount is calculated by choosing central quantizer $Q_{N/2}$, and specifically performing quantization and variable length coding actually. Since the target quantizer is between Q **from** $\mathbf{Q_1}$ N/2 when the code amount is smaller than target code quantity, the same calculation is repeated by middle its quantizer $Q_{N/4}$. Conversely, when a code amount is larger than target code quantity, the same calculation is repeated by quantizer $Q_{3N/4}$. Thus, when there are N quantizers, the target quantizer can be determined by $\log_2 N$ time. The selection process of the quantizer in N= 16 is shown in drawing 7. Drawing 7 shows a selected direction when a code amount of 310 is smaller than target code quantity, and a selected direction when a code amount of 312 is larger than target code quantity, respectively, and 314 shows a selection course in case Q_6 is chosen.

0010 The concrete circuit block figure of the code quantity calculation section 218 is shown in drawing 5. As for a quantization parameter and 236,242,246,250, input data and 232 are **target code quantity and 240,244,248,252** calculation parts quantization number Q_n and 238 a quantization parameter judgment part and 234 230.

0011 On explanation, if the number of small blocks contained in one large block is set to k, the input data 230 possesses the conversion factor to k small blocks. The quantization parameter judgment part 232 gives the parameter with which the feature of a block is expressed to each of k small blocks, and outputs it as the quantization parameter 234. This quantization parameter 234 without quantizing all k small blocks contained in that large block with the same quantizer Qn, when certain quantizer Q_n is chosen to one large block, It controls to apply the quantizers (for example, Q_{n+2}, Q_{n+1}, Q_{n-1}, Q_{n-2}, etc.) which shifted only a few from Q_n relatively to each small block.

0012 The calculation part 240,244,248,252 is a circuit which calculates the above-mentioned draft. The input data 230, the quantization parameter 234, the quantization number 236, and the target code quantity 238 input into the calculation part 240.

The calculation part 240,244,248,252 outputs the quantizer number 242,246,250,254 which should calculate the code amount for one large block (k small blocks), and should be calculated by the next step.

0013 By repeating calculation of the calculation part 240,244,248,252 several times, the last quantizer number Q_n to this large block is obtained. Since drawing 5 is an example in N= 16 and it is dichotomizing search, the quantizer number 236 of the first rank is n= 8, and can determine a suitable quantizer by four calculations 240,244,248,252, i.e., four calculation parts.

0014 Drawing 6 shows the detailed block diagram of the calculation part 510. 262 input data and 264 a quantization parameter and 266 An input quantity child-ized number, 268 a quantizing part and 270 a quantizer selecting part and 272 A variable length coding section, a code amount integrating part, the code amount in which 274 is actual as for 276, and 278 -- as for a code judging part and 286, a subtractor and 282 are **a quantization number selecting part and 296** output quantity child-ized numbers a code judging result and 294 code amount difference and 284 target code quantity and 280.
0015 First, the quantizer selecting part 270 chooses one quantizer or a quantization table according to the input quantity child-ized number 264 and the quantization parameter 266, and the quantizing part 268 quantizes the input data 262 on the selected quantizer or quantization table. The input data 262 is a conversion factor for one large block (i.e., k small blocks), and since the quantization parameter 266 is changed per small block, the quantizer selecting part 270 shifts the quantizer or quantization table to choose according to it.
0016 The variable length coding section 272 carries out variable length coding of the quantized data, and outputs the code length to the code amount integrating part 274. The code amount integrating part 274 integrates the code length who inputs about k small blocks, and outputs the actual code amount of the large block over the input quantity child-ized number 264 to the subtractor 280. The subtractor 280 subtracts the target code quantity 278 from the output 276 of the code amount integrating part 274, and outputs the code amount difference 282. At the time of plus, this code amount difference 282 shows that there are too many code amounts by the present quantization number, and shows conversely that there are few code amounts by it at the time of minus.
0017 Then, the code judging part 284 judges the polarity (namely, plus or minus) of the code amount difference 282, and according to the decision result 286 of the code judging part 284, the quantization number selecting part 294 changes the input quantity child-ized number 266, and makes it the output quantity child-ized number 296. If an input quantity child-ized number is set to n, at the time of code amount over, n- $(N/2^{m+1})$ will be chosen at the time of n+ $(N/2^{m+1})$ and a code amount undershirt. In the example which N shows the number of quantizers, and m shows eye m stage of the calculation part, and is shown in drawing 5, it is N= 16 and m= 1-4. In the calculation part of a final stage, although an output quantity child-ized number becomes below in a decimal point, at the time of code amount over, it is set to n by rounding off at the time of n+1 and a code amount undershirt. These are processings of well-known by binary search.

Effect of the Invention When quantizer Q_n which fills target code quantity is chosen according to this invention so that he can understand easily by the above explanation, by using the insufficient code amount by Q_n, and the excess code amount by Q_{n-1}, ************ attachment ****** is made further and encoding efficiency is improved.

FunctionThe excess code amount at the time of using one step of quantization means with small quantization width from this other than the excess code amount at the time of using the quantization means similarly determined as the conventional example by the above-mentioned means was obtained. And from the obtained insufficient code amount and an excess code amount, the quantization parameter for every small block is controlled, and it brings close to target code quantity as a whole.

ExampleHereafter, with reference to Drawings, working example of this invention is described in detail.
0023 Drawing 1 shows the outline configuration block figure of the code quantity controller which is one working example of this invention. 10 input data and 12 a quantization parameter judgment

part and 14 A quantization parameter, Quantization number Q_n and 18 16, 26, 34, 42, and 52 Initial insufficient data volume, 20 the amount of initial excess data, and 22 target code quantity, and 24, 32, 40 and 48 A calculation part, As for the amount of excess data, and 50, 28, 36, 44, and 54 are **a quantization parameter final controlling element and 60** the quantization parameters after operation insufficient data volume, and 30, 38, 46 and 56 the quantization parameter before operation, and 58.

0024 Since the great portion of operation in the calculation parts 24, 32, 40, and 48 is completely the same as the conventional example shown in drawing 5, it omits explanation and explains characteristic operation with this example in detail.

0025 If two inputs and two outputs are added to each calculation parts 24, 32, 40, and 48 and the 2nd step of calculation part 32 is taken for an example, First, code amount calculation by the input quantity child-ized number 26 is performed, either **which is inputted from the preceding paragraph by the result** the insufficient data volume 28 or the amount 30 of excess data is updated, and it is outputted to the next step as the insufficient data volume 36 or the amount 38 of excess data, respectively. Here, the difference of the code amount and target code quantity by the present quantization number is expressed as shortage/the amount of excess data.

0026 The above four steps of operations are repeated and final shortage / amounts 54 and 56 of excess data are obtained. When the quantization number 52 determined eventually correctly is made into Q_n, the numerals 54 show the data volume which target code quantity runs short of, when it codes by Q_n, and the numerals 56 show the data volume exceeded from target code quantity, when it codes by Q_{n-1}. Respectively, it is equivalent to a of drawing 8 and drawing 9, and b.

0027 Using this shortage/amount of excess data, the quantization parameter final controlling element 58 operates the quantization parameter 50 (delayed although it is the same contents as the quantization parameter 14.), and outputs the new quantization parameter 60. The quantization parameter 60 is a parameter it is directed that uses the quantizer relatively shifted from the Q_n per small block to Q_n chosen as the large block unit, as the conventional example also described. Fine adjustment of a code amount is attained by operating some of the k pieces.

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0029 Since the portion same at drawing 2 as drawing 6 of a conventional example similarly operates, the portion added by drawing 2 is explained in detail.

0030 The code amount integrating part 74 outputs the actual code amount to the input quantity child-ized number 66 on the output line 76, as drawing 6 explained. The subtractor 80 subtracts the target code quantity 78 from the actual code amount 76, and outputs the code amount difference 82. The code judging result 86 shows the numerals of the code amount difference 82, i.e., polarity.

0031 By the code judging result 86, the switch 92 updates either one of **which was inputted** the insufficient data volume 88 and the amount 90 of excess data by the code amount difference 82, and outputs it to the output line 98,100. The data volume which is not updated is outputted as it is. For example, when a code amount exceeds, as shown in a figure, the insufficient data volume 88 is outputted as it is, and the amount 90 of excess data is replaced and outputted with the value of the data volume 82 exceeded by this calculation part.

0032 If it goes via four steps of calculation parts in drawing 1 by this composition, target shortage/amount of excess data will be obtained on the signal wire 54 and 56. This is explained using drawing 7. In drawing 7, 314 shows the process in which quantizer Q_6 is chosen. When an

arrow is followed conversely, it turns out that code amount calculation of Q_6 and Q_5 is made in the 4th step and the 3rd step, and the target data volume is obtained.

0033 Considering the case of another Q_9, the insufficient data volume of Q_9 is obtained in the 4th step, and, as for the 1st step, the amount of excess data of Q_8 is obtained. Since a code amount does not exceed in the 2-4th step, the 1st step of especially amount of excess data is transmitted to the last, without being rewritten on the way. As for other Q_n, since either one of shortage/excess data are not calculated once similarly, a right result is not obtained.

0034 The detailed circuit block figure of the quantization parameter final controlling element 58 of drawing 1 is shown in drawing 3. a quantization parameter input, quantization number Q_n for which 110 was chosen 112, and 114 -- insufficient data volume and 116 -- as for an adding machine and 130, a divider and 122 are **a changeover switch and 134** quantization parameter outputs a comparator and 132 a multiplier and 126 the amount of excess data, and 118.

0035first, the present insufficient data volume to the code amount which increases when the inputted shortage / the amount 110,112 of excess data were set to a and b (a>=0, b>=0) corresponding to drawing 8 and drawing 9, respectively, the divider 118 calculates a/(a+b) and a quantization number is made small one -- 120 is outputted comparatively. Making 1 quantization number small operates all k quantization parameters without changing a quantization number, Since it is equivalent to only 1 shifting the quantization number of each small block to the smaller one, it understands whether it should operate how many of k parameters by increasing this rate 120 k times with the multiplier 122.

0036 The adding machine 126 operates a quantization parameter. If only 1 increases a parameter, specifically, it will be assumed here that it is shifted to a quantizer small **one** . Only 1 has parameter value increased with the adding machine 126, and the parameter of the number specified with the output 124 of the multiplier 122 among the k inputted quantization parameters 110 is outputted to the output 128 as a new parameter.

0037 The comparator 130 judges whether the quantization number 112 is 1 or 16, and since there is the above-mentioned problem at the time of 1 or 16, it is made to output the parameter 110 before operation with the switch 132. Although the number of parameters specified with the output 124 of the multiplier 122 here was comparatively set to 120, since there is possibility of code amount over actually, it is good to lessen some slightly.

0038 When increasing a quantization parameter value with the adding machine 126, about from which small block it carries out. for example, the order from the thing which has small parameter value and which makes deferment order or what has an already large quantization parameter value from the block of a Y signal when there is a block of a Y signal and a color-difference signal -- the said method can be considered.

0039 Although one working example of this invention was described, the fundamental view of this invention is explained anew here. Operating all k quantization parameters of each small block so that a quantizer small **one** may be chosen, If it is equivalent to using Q_{n-1} instead of quantization number Q_n of the whole large block without completely operating a quantization parameter, therefore 0-k quantization parameters are operated, quantizer Q_n - Q_{n-1} will be obtained equivalent.

Problem(s) to be Solved by the Invention The problem of a conventional example is explained using drawing 8 and drawing 9. Each of these figures shows only the code amount by eventually selected quantizer Q_n, and one size relation of the code amount by small quantizer Q_{n-1}, and target code quantity, and a and b show the difference of the code amount of Q_n and Q_{n-1}, and target code quantity among a figure, respectively. That is, when it quantizes by Q_n, only a has few code amounts than target code quantity, and when it quantizes by Q_{n-1}, it is shown that a code amount exceeds only b. Case **like drawing 8** , the value of a is small and encoding efficiency is good. However, case **like drawing 9** , a became quite large, encoding efficiency is bad, and if it can do, since the code amount over of only only b arises, the quantizer Qn will have been chosen

unavoidably but the place to choose quantizer Q_{n-1} as.

0019 An object of this invention is to show the code quantity controller which solves such a problem.

Means for Solving the Problem Two or more steps of code amount calculating means which calculate encoding quantity by a code quantity controller concerning this invention being a code quantity controller which makes a code amount at regularity a large block unit which consists of two or more small blocks, The shortage / excess code amount to target code quantity in each stage by a calculation result of a means of communication transmitted to the latter part, and the code amount calculating means concerned. An update means which updates either one of a transmitted insufficient code amount and an excess code amount is provided, According to the shortage / the excess code amount concerned obtained in a final stage of the code amount calculating means concerned, it operates and has a quantization parameter at each above-mentioned time of carrying out small block coding, and a generated code amount is brought close to the target code quantity concerned.

Brief Description of the Drawings

Drawing 1 It is an outline configuration block figure of the code quantity controller which is one working example of this invention.

Drawing 2 It is a detailed circuitry block diagram of the calculation parts 24, 32, 40, and 48.

Drawing 3 It is a detailed circuit block figure of the quantization parameter final controlling element 58.

Drawing 4 It is an outline configuration block figure of conventional highly efficient coding equipment.

Drawing 5 It is an outline circuit block figure of the code quantity calculation section 218.

Drawing 6 It is a detailed block diagram of the calculation part 240,244,248,252.

Drawing 7 It is an example of the selection process of a quantizer.

Drawing 8 It is an explanatory view of the relation of the code amount and target code quantity of quantizer Q_n and Q_{n-1}.

Drawing 9 It is an explanatory view of the relation of the code amount and target code quantity of quantizer Q_n and Q_{n-1}.

Description of Notations

10: Input data
12: Quantization parameter judgment part
14: Quantization parameter
16, 26, 34, 42, 52: Quantization number Q_n
18: Initial insufficient data volume
20: The amount of initial excess data
22: Target code quantity
24, 32, 40, 48: Calculation part
28, 36, 44, 54: Insufficient data volume
30, 38, 46, 56: The amount of excess data
50: The quantization parameter before operation
58: Quantization parameter final controlling element
60: The quantization parameter after operation
62: Input data
64: Quantization parameter
66: Input quantity child-ized number
68: Quantizing part
70: Quantizer selecting part
72: Variable length coding section

74: Code amount integrating part
76: A actual code amount
78: Target code quantity
80: Subtractor
82: Code amount difference
84: Code judging part
86: Code judging result
88: Insufficient data volume input
90: The amount input of excess data
92: Changeover switch
94: Quantization number selecting part
96: Output quantity child-ized number
98: Insufficient data volume output
100: The amount output of excess data
110: Quantization parameter input
112: Selected quantization number Q_n
114: Insufficient data volume
116: The amount of excess data
118: Divider
122: Multiplier
126: Adding machine
130: Comparator
132: Changeover switch
134: Quantization parameter output
210: Large blocking part
212: Small block-ized part
214: Orthogonal transformation section
216: Quantizer
218: Code quantity calculation section
220: Quantizer selecting part
222: Variable length coding section
230: Input data
232: Quantization parameter judgment part
234: Quantization parameter
236, 242,246,250,254: Quantization number Q_n
238: Target code quantity
240,244,248,252: Calculation part
262: Input data
264: Quantization parameter
266: Input quantity child-ized number
268: Quantizing part
270: Quantizer selecting part
272: Variable length coding section
274: Code amount integrating part
276: A actual code amount
278: Target code quantity
280: Subtractor
282: Code amount difference
284: Code judging part
286: Code judging result
294: Quantization number selecting part
296: Output quantity child-ized number
310: A selected direction when a code amount is smaller than target code quantity
312: A selected direction when a code amount is larger than target code quantity
314: A selection course in case Q_6 is chosen

Drawing 1

For drawings please refer to the original document.

Drawing 3

For drawings please refer to the original document.

Drawing 5

For drawings please refer to the original document.

Drawing 8

For drawings please refer to the original document.

Drawing 2

For drawings please refer to the original document.

Drawing 4

For drawings please refer to the original document.

Drawing 7

For drawings please refer to the original document.

Drawing 9

For drawings please refer to the original document.

Drawing 6

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